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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/825,870	04/05/2001	Leonid Grigorian	052833-5004	3120

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EXAMINER

LISH, PETER J

ART UNIT	PAPER NUMBER
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1754

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DATE MAILED: 08/15/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary

Application No.

09/825,870

Applicant(s)

GRIGORIAN ET AL.

Examiner

Peter J Lish

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 October 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☒ Claim(s) 5,6,10,14-16 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 6 objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. The parent claim, claim 1, states in line 6 that the reaction gas is to be "methane gas". The dependent claim, claim 6, states that the reaction gas is to be "methane or a mixture of methane and a carrier gas" (lines 24-25). In order to correct this broadening of the parent claim, it is suggested that "a gas containing methane" replace "methane gas" in claim 1.

Claims 5, 10, and 14-16 objected to because of the following informalities: The ratio of the given catalyst metals is defined, however the basis of this ratio is not. It is provided in the specifications that this ratio is a molar ratio. The claims must be corrected in order to reflect this, else they be indefinite. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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Claims 1-14 and 17-18 rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco et al. (USPN 6,333,016) in view of Hernadi, K et al ("Fe-Catalyzed Carbon Nanotube Formation" Carbon, Pergamon, 1996, Vol 34, No. 10, pp. 1249-1257).

Regarding claims 1-3 and 11-12, and 17-18, Resasco discloses a method "for producing single-walled carbon nanotubes comprising contacting bimetallic catalyst particles consisting essentially of a Group VIII and a Group VIb metal with an effective amount of a carbon-containing gas in a reactor heated to a temperature of from about 500 to 1200 °C, preferably from about 600 to about 850 °C and more preferably from about 650 to about 750 °C and most preferably about 700 °C" (column 4, lines 34-42). He later discloses that methane is a preferred feed gas for formation of SWNTs (column 5, lines 58-60). While Resasco does not list iron, a known Group VII metal catalyst, with his acceptable Group VII metals (column 4, lines 55-56), Hernadi et al. teaches the synthesis of carbon nanotubes in the decomposition of hydrocarbon gases over supported iron catalysts in the same temperature range (p.1249, 1st paragraph of experimental section). Thus it would have been obvious to one of ordinary skill in the art at the time of invention to include iron metal as an acceptable Group VIII metal in a carbon nanotube growth catalyst.

Regarding claims 4, 9, and 13, Resasco discloses "the metallic catalytic particles may comprise more than one metal from each of Groups VIII and VIb as long as at least one metal from each Group is present." (column 5, lines 17-20). He further teaches the use of alumina (Al_2O_3) as a preferred support for the catalyst (column 5, lines 31-33).

Regarding claims 5, 10, and 14, Resasco teaches, "the ratio of the Group VIII metal to the Group VIb metal is preferably from about 1:10 to about 15:1" (column 5, lines 10-13). Further,

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“the total amount of bimetallic catalyst deposited on the support may vary widely, but is generally in an amount of from about 1% to about 20% of the total weight of the metallic catalytic particle” (column 5, lines 41-44). The claimed ratios of the catalyst components are viewed as falling under these ranges.

Regarding claims 6 and 7, Resasco states “the carbon-containing gas may optionally be mixed with a diluent gas such as helium, argon, or hydrogen” (column 5, lines 60-61).

Regarding claim 8, Resasco shows carbon monoxide (carbon-containing) and helium (carrier) gas mixture in the ratio of 50%-50% (column 8, line 47). It is further seen from Figure 10 that tests were done while the ratio was decreased until the CO content was only 1%.

Regarding claims 9 and 13, Resasco reveals “the single-walled carbon nanotubes produced herein generally have an external diameter of from about 0.7 nm to about 5 nm” (column 6, lines 18-20).

Allowable Subject Matter

Claims 15 and 16 would be allowable if rewritten to include all of the limitations of the base claim and any intervening claims.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: (USPN 4,770,867); (USPN 5,102,647); (USPN 6,413,487); (USPN 5,997,832); (USPN 6,159,892); (USPN 6,361,861).

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Peter J Lish whose telephone number is unavailable. The examiner can normally be reached on 8:30-5:00 Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley Silverman can be reached on 703-308-3837. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-305-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

PL
August 8, 2002



STUART L. HENDRICKSON
PRIMARY EXAMINER